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ABSTRACT

This paper describes a series of preliminary and a double blind study on crossed visual laterality and reading difficulties in children. Preliminary studies investigated handedness, eye preference, and ear preference in a total of 196 third and fifth grade students. About 42 percent of the tested students were identified with the Monahan/DeYoung Syndrome, i.e., they were left-eyed (at three different ranges), left-eared, and right handed (or vice versa). Tests of kinesthetic, visual, and auditory processing found that subjects performed significantly better in their sided/natural state. The double blind study examined the effect of the sinistral inverted (hook) reading technique when applied by 43 students with the Monahan/DeYoung Syndrome on standardized accuracy and comprehension reading scores when compared to controls. Results indicated that the sinistral-inverted treatment group showed a significantly greater increase in reading accuracy and in reading comprehension than either of the other three groups, namely, the sinistral non-inverted, the dextral-inverted, and the non-dextral-inverted. The paper concludes that sidedness in children must be determined by identifying the reading-range eye and aligning this eye to the hand for reading. (DB)

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LEVELING THE LEARNING FIELD
NEAR-SIDEDNESS: THE CIRCUIT TO LITERACY*

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ABSTRACT**

For the past century, lack of sidedness (mixed laterality) and its interference with the reading process has been extensively studied and argued. Diagnosis for sidedness has been dependent upon the identification of the sighting or far range eye. In contrast, this study examined the significance of the 16" reading range eye as the determining factor for sidedness. This eye is often not the same as the far range or sighting eye. As the research unfolded, both in the Preliminary and Double Blind studies, it became evident to these researchers that the uniqueness of the 16" reading range eye would have profound implications for students with reading problems.

Beyond a statistical doubt, students from highly diverse ethnic and socio-economic backgrounds and various educational programs completed their assigned academic, visual, auditory, and kinesthetic tasks in a far superior manner in their sided/natural states. Most critically, thirty five percent of these students would have been incorrectly identified as being sided because their far range eye was the same as their handedness.

Therefore, this research recommends that proper diagnosis for sidedness, at the 16" reading range must be a consideration for any evaluation of reading problems. Treatment must include the proper positioning of reading materials as well as the utilization of the "Sinistral Inverted Reading Technique." Equity and access to the curriculum may then be truly afforded to all students, thus leveling the learning field.

These beliefs have been substantiated by the findings of the statistical "Double Blind Study." The dependent variables were change in reading accuracy and comprehension, as measured by the difference between the Gilmore Oral Reading Test Form B (post) scores and the Gilmore Oral Reading Test Form A (pre) scores. Change scores were adjusted for the possible influence of the pre-experimental reading accuracy and comprehension scores. In both accuracy and comprehension, with p values respectively of .002 and .000, the average change for the "Sinistral Inverted Reading Technique" group was significantly greater than the comparative groups, none of whom were found to be statistically different from each other.

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* The authors of this paper wish to acknowledge three contributors to the experimental designs for both the Preliminary and Double Blind studies. They are: Marc Lerner, M.D., Associate Clinical Professor, Behavioral Pediatrics, Child Development Center, University of California, Irvine; Harry Pellman, M.D., Clinical Professor of Pediatrics, University of California, Irvine; and, James Swanson, Ph.D., Director, Child Development Center of Pediatrics, Psychiatry, and Social Science, University of California, Irvine. The authors would also like to acknowledge Gregory J. Mueller, O.D., Vision Therapy Specialist, for his assistance regarding fusion and eye convergence.

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Introduction

Imagine this scenario. You have had a very long and difficult day at work. No one seems to listen. Deadlines are looming. You are anxious to return home to relax from the tension of the day.

Unfortunately, when you arrive home, you find that the electricity is off. You fumble in the darkness to find that flashlight you have hidden for emergencies. Alas, you hope to see your way to the light switch, but the flashlight is not working. Are the batteries now in a toy that your youngest needed? You open the flashlight and discover, yes, there are batteries. But, no, the batteries are improperly placed so that the circuitry is incomplete. The lights, electrical- or battery-operated, will not work unless the circuitry is complete. You are reminded of the old saying, "The lights are on, but nobody is home." In your case, you are home, but the lights are certainly off.

In this highly technological society, mechanical problems continue to exist. Incomplete circuitry exists not only in a mechanical sense, but also within the human brain. How many children or adults do you know who are unable to read because they cannot visually process the written word? Lack of circuitry? Incomplete wiring?

Two authors of this study have observed a rather unusual phenomena over the past twenty-some years. In the confines of a classroom, students were predominately right-handed; however, when observing their playground behavior, as many as one-third of these same students exhibited left-handedness and left-footedness. Coincidence? Ambidextrous? When investigating the academic progress of these students, they discovered that, almost without exception, the students were decidedly below grade level in reading, particularly in reading comprehension. Did mixed sidedness affect their ability to read? When discussing our findings with parents, they readily informed us that they had deliberately changed their child's handedness, usually from left to right. They didn't, however, change their child's "eyedness." Did they unknowingly short-circuit their child's academic prowess? Were their actions equivalent to a computer's hard drive crashing?

Personal interest prevailed in that one of the authors was completely left-sided and had no problems in the area of reading. However, another author was left-eyed at the **16"** reading range, but right-sided in all other aspects and exhibited many problems learning to read. Do you know if your circuitry is connected? Are you near-sighted when you should perhaps be near-sided?

Literature Review

A study of ancient cave paintings and tools employed by Stone Age man has revealed that there were about as many left-handed as right-handed individuals among our remote ancestors.

Right-dominance appeared in the Bronze Age. There was a "Weapon Theory," which speculated that the right-handed individuals of the Hunter-Warrior Stone Age Period survived because they carried their weapons in the right hand and protected their hearts by means of a shield. Also, their scythes were designed for wielding by right-handed individuals.

The emergence of laterality in mankind – with dominance of one side of the body, usually the right eye, right hand and right foot under the control of the left cerebral hemisphere – is a subject that has been fully explored for centuries.

Eye dominance was first noted in 1883 by Lombroso (Wagner, 1971). He concluded that eye preference probably underlies foot and hand dominance, since the eye controls the hand. He determined that eyedness is a more significant factor in determining one's dominance because, the person is not aware of his or her preferred eye and environmentally is not encouraged to change this dominance.

We must realize that reading involves our eyes, but it goes far beyond the eyeball proper. The child has to be able to interpret what they see; and this is called visual perception, again only one aspect of the total reading process. In connection with visual perception, the mystery words *mixed dominance* are often heard. Among the theories and methods which take this confused eye-hand-foot coordination into consideration are Dr. Samuel Orton's contributions

and the Doman-Delacato method. The subject is controversial to this day, to say the least; and conclusive evidence is still to be presented to the serious researcher under laboratory conditions (Denckla, 1979).

The issue or confusion over the role of dominance was first raised by Orton in 1937. His view was that many of the delays and defects in the development of the language function may result from a deviation in the process of establishing unilateral brain superiority. This concept of hemispheric dominance was a sensation among educators, and Orton's views were widely circulated. However, Orton's ideas fell into disrepute following World War II, at least in academic and educational circles. This was due, in fact, to a trend away from organic theories of mental disorders and toward theories based on depth psychology or on Learning Theory.

A more recent paper, authored by Michael C. Corballis and Ivan L. Beale of the University of Auckland, points out that Orton's theory may provide insight as to ***why*** some children fail to develop analytic procedures, which are so essential to the reading process. Words have a specific property that sets them apart from all other patterns. That property is directionality. Failure to develop the cerebral mechanisms to deal with directionality might therefore account for the frustrating specificity of dyslexia (Corballis & Beale, 1989).

These authors have reviewed a voluminous amount of literature in order to determine what methods have been utilized to ascertain one's "sidedness," especially relating to eye dominance. Without exception, we found examiners identifying the "sighting" or far – range eye. These ranges far exceed the approximate 16" distance, which is required for reading.

Orton utilized the sighting eye as one of his criteria for determining cerebral dominance (Orton, 1937). During the forties and fifties, a myriad of researchers found no significant relationship of handedness and sight eye preference and reading disability (Flax, 1966).

Levy and Reid describe a pointing test to determine eye dominance: subjects fixated on a spot approximately **6'** away, with their index finger of their dominant hand pointing to the spot. They were told to alternately close each eye while maintaining the pointing position and to report when the finger seemed to move away from the spot (Levy & Reid, 1978). Goldberg states that eye dominance can be tested crudely by teachers or parents by asking the child to hold a simple funnel in front of both eyes, with the examiner looking at the aperture facing him/her to note the dominant eye. The dominant eye will show through the hole pointing toward the observer. Goldberg concludes that confused dominance does not appear to mean anything by itself but often contributes to the adverse signs in reading problems by adding to the child's poor reading ability. Some normal readers also have this confusion in sidedness but seem to be able to compensate for it (sometimes by superior intelligence) (Goldberg, 1983).

By the late fifties the term "dominance" had been put into the literature as meaning cortical hemispheric dominance; and the relationships between the two eyes were investigated in terms of a dominant-subdominant relationship. The concept of dominance and the dominant eye as it related to reading fell into disrepute, because sighting was used synonymously with dominance. The error was the result of dealing with the eye instead of the hemisphere that it represented. Delacato states, "eye-hand coordinations are initiated at a subcortical level and are essentially developed at the midbrain stage of mobility, which takes place at about nine months of age in the normal child." Eye-hand relationships are a prerequisite to language development, but the important factor is <u>which eye and which hand and what neural level and hemisphere</u> do they represent? (Delacato, 1959)

The literature review relating to the implementation of the kinesthetic method of learning, as it relates to remedial reading,
was quite sparse. Orton advocated the remedial use of kinesthetic stimulation, by encouraging dyslexic children to point to words and letters while reading (Orton, 1931).

Levy and Reid suggested that the hand posture adopted during writing might be an index of the lateral relationship between the dominant writing hand and the language hemisphere, a normal posture indicating contralateral language specialization, and an inverted posture indicating ipsilateral language specialization. They further reported data indicating that writing posture predicts cerebral lateralization in 95 percent of the cases studied, using visual hemisfield procedures to assess cerebral lateralization (Levy & Reid, 1982).

Our extensive review of the literature did not disclose one study that incorporated one's reading range eye. Furthermore, we could not ferret out a single research design that utilized the "hooked reading posture" in relationship to reading in a kinesthetic fashion. In short, the immense amount of literature regarding crossed laterality was of limited value to us.

The Problem

Over the past century, a great deal of research has been devoted to the subject of mixed lateral dominance and the inability to read. [Whittey and Kopel (1936), Orton (1937), Zangwill (1960), Benton (1962), Zurif (1970), Kaufman (1980), Corballis (1990)]. Our extensive research differs not in the concept itself but rather in the identification of mixed laterality. All research to date determines the visual portion of sidedness by identifying the sighting far– range eye. Our study is unique in that we identify ***the reading range eye (approximately 16" range eye) as the critical factor in determining sidedness***. We are of the opinion that far – range identification has been the problem in ascertaining sidedness (laterality). Two of the authors have developed an instrument **(referred to as the Bi-mono-scope)** and a procedure for accurately identifying the reading range – eye. A world-wide search was conducted regarding the originality and effectiveness of this instrument; a U.S. patent has been granted to two of the authors (#5,349,397).

Our research has led us to believe that approximately 40% of the world's population should have been left-handed. This is a far cry from the eight to ten percent figures published by the "Left-Handers International Organization." Handedness is being changed in America in the 1990's just as readily as it was in the 1890's; in fact, it might be more prevalent today. There are three main factors that lead to the changing of handedness:

1. Handedness is changed purposely, due to cultural beliefs. (Asian, Hispanic and Middle Eastern cultures).

2. It is changed inadvertently by placing items, such as eating utensils, pencils, and crayons in the child's right hand.

3. One changes oneself to be more accommodating to the world (the old cliché - "it's a right-handed world").

The hand is changed, but the reading – range eye remains unchanged. The naturally developed reading – range eye is established in infancy, long before the preferred hand (three to four years prior).

We further believe that the ability to read and comprehend is greatly enhanced when the reading – range eye is the determining factor in establishing sidedness; conversely, the lack of sidedness jeopardizes one's ability to learn.

Preliminary Studies

Our preliminary studies commenced in November of 1992. A total of 196 third and fifth grade students were screened: 107 at Circle View School, and 89 at Lake View School. Both schools are located within the Ocean View School District, Huntington Beach, California.

An individualized Testing Profile Sheet was utilized on each subject. The following information was obtained:
Name, date, ethnicity, school, grade, teacher, date of birth, date(s) tested.

Handedness was determined by (a) placing a pencil in the center of the profile information sheet. The subject was then asked to write their full name; (b) the subjects were then asked to pick up a tennis ball and throw it a distance of 25 feet; and, (c) the subjects were asked to place their hands at their side and, upon command, activate a telegraph apparatus as quickly as possible. All these hand exercises were recorded.

Eye preference was determined by means of the Bi-mono-scope. Our patented device can identify one's preferred eye at three distinct ranges: near (needle point), sixteen inches reading range and far point, fifteen feet. Each preferred range was recorded. The Keystone telebinocular was utilized to determine near- and far-point fusion, which is defined as the integration of the two images of an object, seen by two eyes, into one (Delacato, 1959).

Ear preference was determined by (a) asking the subject to put an ear down on the table top in order to ascertain whether or not they could hear a "Mickey Mouse" watch ticking within a small jewelry box; (b) the subjects were then asked to answer a telephone which contained a two-way receiver, and to maintain a conversation for a twenty second period of time. (The twenty seconds allows for transfer). Both exercises were recorded.

Forty-seven subjects, or 43.9% of the tested students at Circle View School, were identified as having the Monahan/DeYoung Syndrome. In other words, they were left-eyed (at all three ranges), left-eared, and right-handed (or vice versa), as determined by our testing profile.

Thirty-nine subjects or 43.8% of the tested students at Lake View School were identified with the syndrome. (Incidental testing previous to our study, approximately 300 subjects in all walks of life, indicated that the 42% is **consistent** within any diverse population).

The names of all identified subjects were written on a two-by-five-inch piece of paper and placed in a "hat." Twenty-four Circle View subjects who were identified as having the syndrome were drawn, twelve 3rd graders and twelve 5th graders. Twelve subjects who were totally sided were then drawn from a pool of 60. The 24 syndrome subjects were **selected randomly** a second time and alternately placed in the "treatment" or "comparative" group. The sided subjects were placed in a "regular" group.

The identical process was repeated at Lake View School. However, due to time constraints, four rather than six subjects comprised each group.

Testing Protocol and Procedures - (Reading assessment)

The Gilmore Oral Reading Test was administered to all subjects in both the Preliminary and the Double Blind studies (**to be described later in this paper).** All subjects were pre- and post-tested utilizing this instrument. The Gilmore was chosen for this study because it provides measures of accuracy relating to oral reading and comprehension of material read. Also, there are two equivalent forms, "A" and "B," which enabled the psychomotrist to compare accurately the results from pre- to post-testing. Standard scores and grade equivalents are provided for both accuracy and comprehension portions of the test, thus allowing for comparisons with other tests that might be utilized in future studies.

Finally the Gilmore Oral Reading Test has shown statistical evidences of its validity, reliability and equivalence of forms. (Statistical analysis of reading comprehension and reading accuracy can be found in the Gilmore Manual of Directions, Harcourt, Brace and World Inc., New York).

Kinesthetic (Dexterity and Rhythmic), Visual and Auditory Performance Testing

Four screening exercises in the above categories were developed by Monahan and DeYoung. The purpose of these exercises was to determine in which state, functional/operational, or sided/natural, the subjects excelled regarding hand/eye coordination. Our beliefs were substantiated when all four exercises proved statistically significant for those subjects who utilized their sided/natural state.

The decision not to include the visual and auditory screening exercises in the Double Blind Study was two-fold:

1. There was only a remote possibility for experimental effects due to the accurate timing instrument utilized in the Preliminary Study (Breitling Geneue Laboratory Stop-watch).

2. Time and monetary constraints made the inclusion of these exercises prohibitive at this time.

All of these kinesthetic exercises were administered in two distinct states:

1. Functional/Operational: The state in which the subject functions prior to any visual, auditory, or kinesthetic diagnosis. In reference to this study, it would be the subject's non-sided state.

2. Sided/Natural: The subject's eye, ear and hand were occluded after diagnosis of the reading range eye in order to establish a condition of sidedness or the subject's natural state.

All these screenings were timed with accurate timing devices. Scores were recorded and comparisons were made according to the operational and natural states.

Kinesthetic: Telegraph - (Dexterity Tap Test)

We constructed a replica of a telegraph apparatus. However, we substituted a flashing light in lieu of the commonplace buzzer, in order to eliminate the noise factor when testing within the confines of a classroom.

The examiner thoroughly explained and demonstrated the testing procedures (rules) involved in playing the telegraph game. The palm of the hand must rest on the table top in a stationary position throughout the testing period. The index finger is extended so that it is positioned directly above the sending key. The subjects are directed to activate the light bulb on the apparatus as many times as possible within a ten second time frame. Subjects were alternated in the administration of the test. One subject would commence in his/her functional/operational state and the following subject in the sided/natural state. Again, to minimize "practice" the subjects were administered the telegraph test in his/her opposite state at a subsequent testing period.

The purpose of the telegraph test was to attempt to ascertain in which state – functional/operational or sided/natural – the subject demonstrated the higher degree of dexterity.

Findings: subjects performed with a higher degree of dexterity in their sided/natural state.

Kinesthetic: Rhythmic, Coordination Exercise

The examiners were attempting to ascertain in which state (functional/operational or sided/natural) the subjects excelled regarding rhythmic coordination. The subjects were directed to grasp a small object (jelly bean) from a cup measuring 1-1/4" in diameter and 1/2" in depth and lift the object to a height of approximately 15 inches. The object is then placed back into its original position, subject claps his/her hands together, and repeats the process for 15 seconds. The object is to determine how many times the subject can correctly complete the series within the allotted time frame.

The exercise was administered in both the functional/operational state and the sided/natural state. To aid in the alleviation of "practice," the second stage of this exercise was administered at a subsequent screening session.

Findings: subjects demonstrated superior rhythm and coordination in their sided/natural state.

Visual: Alpha Exercise - (Memory Transfer Process)

The exercise board is a ten-inch-square block containing nine 3/8" dowels. The dowels are spaced 3-1/2" apart and stand 1-1/4" high. The purpose of this visual exercise is to ascertain which learning state – functional/operational or sided/natural –is superior regarding the visual memory transfer process.

Subjects were requested to produce capital letters (fifteen possible) or lower case letters (sixteen possible) of the alphabet by wrapping a single string, looped on both ends, around the pre-described dowels, utilizing the entire exercise board. The subjects were instructed not to double back (make a double line) while forming the letters.

Subjects were allowed three minutes to complete this visual processing task (an egg timer was utilized to assure uniformity of time).

The "alpha A" portion of the exercise, capital letters, was administered in the subject's non-sided state. Only the functional hand was used while completing the task. Attempts to use the non-functional hand to assist were recorded. The "alpha B" portion of the exercise, lower case letters, was administered in the subject's sided state.

Findings: subjects excelled in their sided/natural state. Non-sided subjects experienced a great degree of difficulty in performing the task.

Auditory - (Auto Bean Exercise)

Subjects were asked to respond to a series of standardized commands. The commands graduated from two to a complexity of seven. The exercise board consists of seven colored cups. At the conclusion of each command, the

subject was expected to momentarily place a "jelly bean" into each color requested by the examiner. Upon completion of the task, the jelly bean was returned to the neutral cup (white).

Example: From white to green to red to yellow to black to orange to white.

All commands were given at the exact rate of speed (approximately one second intervals) and with the same voice intonation.

One portion of the exercise was administered in the subject's non-sided state (functional/operational). Being cognizant of "practice," the occluded (sided) portion of the exercise was administered by reversing the commands.

Findings: auditory commands were processed at a significantly higher rate with the sided/natural subjects.

Group Schedules, Functions, and Composition

We worked directly with students for approximately three months. Generally, we would work with a specific group (i.e., third-grade treatment for a period of time (usually forty minutes), three times a week). The groups were never mixed for instructional purposes. Extra time was spent with the treatment group (usually about ten minutes per session' due to the constant physical reinforcement of the scanning method (see methodology)..

The sessions with the treatment and comparative groups were virtually identical in format, with the exception of those involved with the scanning method. However, our meetings with the regular groups were quite casual. We kept bolstering them and encouraging them to do their very best. Since they were totally sided (either left or right), we felt that they should progress at a normal rate of growth.

The composition of each group was academically and ethnically diverse. Students from Gifted and Talented Education (GATE), Special Education, and Limited English Proficient (LEP), participated. Ethnic groups represented were: Asian, Hispanic, Middle-Eastern, Caucasian, and American-Indian.

When we concluded our preliminary research study in August of 1994, we requested that Marcel Kinsbourne, noted behavioral neurologist of Tufts University, review our findings. He replied, "As I am sure you know, the crossed laterality pattern that you term the Monahan/DeYoung Syndrome" has been well recognized and intensively studied for a century. The proposition that this affects learning to read has often been tested, but only occasionally with a supportive outcome." We totally concur with Dr. Kinsbourne's statement. Over 100 years of extensive research in and of itself substantiates our belief that there must be a link between reading disability and crossed laterality.

2 x 2 Double Blind Study

The Double Blind Study was conducted at Lake View School during the 1994/95 school year. The purpose of the 2 x 2 study was to determine the effect of the sinistral inverted reading technique (hook) when applied to students possessing the Monahan/DeYoung Syndrome (left eyed, 16" reading range, left-eared, and right handed) on standardized accuracy and comprehension reading scores. Identical sampling procedures were utilized by the psychometrist and coordinator of the Double Blind Study as were used in the Preliminary Study.

Forty-three randomly selected students of a given age and grade were assigned to each of the following groups:

Treatment Group I: These students were identified with the Monahan/DeYoung Syndrome. Between reading test one and test two they received reading comprehension instruction utilizing the sinistral inverted (hook) technique.

Treatment Group II: These students were identified with the Monahan/DeYoung Syndrome. Between reading test one and test two they received reading comprehension instruction and read with guidance from the left hand (sinistral non-inverted technique).

Comparative Group I: These students had ipsilateral sidedness (non Monahan/DeYoung Syndrome). Between reading test one and test two they received reading comprehension instruction utilizing the dextral inverted (hook) technique.

Comparative Group II: These students had ipsilateral sidedness (non Monahan/DeYoung Syndrome). Between reading test one and two they received reading comprehension instruction and read with guidance from the right hand (dextral non-inverted technique).

The reading instructor had no previous knowledge of this study. She was able to ascertain that students were reading in different (peculiar) fashions but had no basis to determine why.

The pre-reading tests were administered in the student's "normal" reading state. No kinesthetic reading techniques were applied or allowed. The post test was administered within the confines of a reading a carrel. Thus, the reading hand could not be observed by the tester; ***HENCE, A BLIND ELEMENT OF THE STUDY.***

Students had no knowledge of their groupings, thus a ***DOUBLE-BLIND ELEMENT OF THE STUDY.***

The duration of the Double-Blind Study was twelve weeks. Our Preliminary Study indicated that a ten- to twelve-week training period was sufficient for hemispheric transfer to occur. We refer to this phenomenon as "hemispheric celebration," because we believe that this process significantly decreases "hemispheric competition," thus enabling students to succeed by leveling the learning field.

Methodology - Treatment

To help alleviate confusion in the minds of our readers, we will refer hereafter only to left sidedness preference., those subjects who are left-eyed (at a sixteen-inch reading distance), left-eared, but right-handed (left-sidedness preference comprised 99% of the **subjects** in our studies).

Try to picture in your mind an awkward looking left-handed person in a writing position. Their arm is "hooked" and the paper upon which they are writing is tilted to the extreme left. (approximately 45 degree angle). The position of the paper resembles that of a right-handed person writing in a "proper" fashion. It appears that they are almost writing upside down. It is our contention that this "awkward" appearing writing posture is the "proper" position for the left-handed writing person. Our theory is reinforced by Levy and Reid (1978).

They suggest that those individuals who write with their hands in an upright position, like most right-handers, have speech and motor movement controlled from the contralateral hemisphere; whereas, those who write in an overhand, or "hooked," position have ipsilateral control. Thus, left-handers who use the hooked pattern are left-hemispheric for speech and should show the same lateral asymmetries as do right-handers. Conversely, those who write in an upright fashion should show right-hemispheric speech. They further reported data indicating that writing posture predicts cerebral lateralization in 95% of the cases, using visual hemifield procedures to assess cerebral lateralization.

The first phase of our sidedness treatment was to convert our subjects to the left-handed "hooked" position for the purpose of reading. Since the left hemisphere of the brain is considered the "school hemisphere," we felt that it was advantageous for our subjects to utilize this language hemisphere (Levy & Reid, 1978).

The second phase of our treatment was to incorporate the kinesthetic modality into the process. We refer to this method as the "Sinistral Inverted Reading Technique." This is accomplished by placing the thumb of one's left hand against the center of one's closed index and middle fingers, approximately one inch from the top of one's middle finger, thus forming a three finger "scanner." Scanning must be conducted in a "hooked" position. This is accomplished by bending the wrist at an angle that approximates forty-five degrees. Materials that are being read must also be positioned at an approximately forty-five degree angle to the left. The sequential three step process is as follows:

1. Subjects are instructed to feel (kinesthetically) above each printed word as they progress from left to right, top to bottom. They are encouraged to read in a deliberate, rather slow, fashion and in a soft, whispering voice.
2. After utilizing the above method for six to eight weeks, subjects will progress to reading word phrases.
3. Finally, subjects will be able to scan entire lines by moving their scanner in a vertical fashion down the left

margin of a given page.

This scanning method of reading enables the subjects to incorporate all three modalities of learning, visual, auditory and kinesthetic.

Findings: Even though students were randomly assigned to the four test categories, it was felt that an analysis of the relationship between the pre- and post-accuracy scores and the pre- and post-comprehension scores would be of value. Exhibits 1 and 2 indicate the relationship between the accuracy scores and the comprehension scores for each of the four groups in the study. These groups have been referred to as:

SI	sinistral inverted
SNI	sinistral non-inverted
DI	dextral inverted
DNI	non-dextral inverted

EXHIBIT 1.

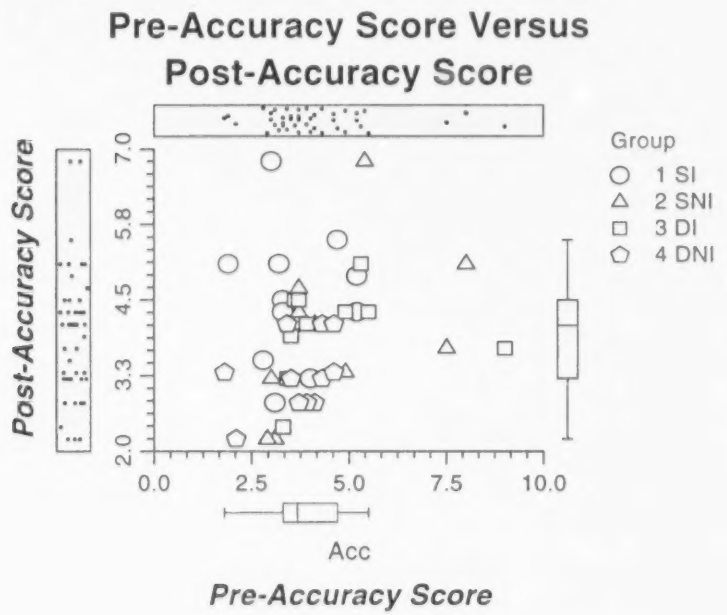
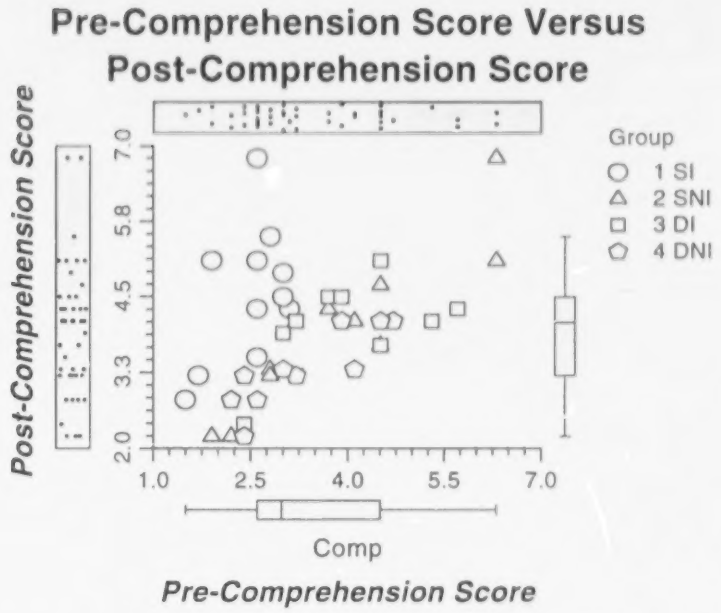


EXHIBIT 2.



It is clear from these scatter plots that some relationship exists, although weak, between the pre- and post-test scores. It should be noted that the SI group, in both Exhibits 1 and 2, shows a regression different from the other three. Although not assessed in this research, it appears that the slope for SI is not different from 0, while for the other three there is a positive slope. Therefore, to allow for the possible effect of the pre-test scores on the post-test scores and change in scores during the study, an analysis of covariance was the chosen methodology. The dependent variables are the change in accuracy and change in comprehension. The independent variables (classifications) are the group and the sex of the subject. The covariates are the pre-test scores.

Exhibit 3, presents the analysis of covariance table in which the dependent variable is the change in accuracy scores, the covariate is the pre-accuracy score and the independent factors are group and sex.

EXHIBIT 3. Analysis of Covariance Report for Accuracy Change Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F	p Value
X(Pre-Accuracy)	1	2.95	2.95	4.14	.050*
A(Group)	3	12.39	4.13	5.78	.002**
B(Sex)	1	0.04	0.04	0.05	.825
AxB	3	1.03	0.34	0.48	0.698
Residual	34	24.27	0.71		
Total(adjusted)	42	43.60			

* Significant at α = .05; ** Significant at α = .01.

From Exhibit 3, the following conclusions can be drawn:

1. with a p = .04999, the hypothesis of no correlation between the pre-test accuracy score and the change in accuracy scores is rejected.
2. with a p = .0026, the hypothesis of no difference in average change in accuracy scores across the four groups, when adjusting for the significant linear effect of the pre-test accuracy scores, is rejected.
3. with p values of .825 and .698, the following hypotheses were not rejected:

No difference in average change between males and females and no interaction between sex and group with respect to average change in accuracy scores.

The use of Fisher's LSD test indicates that Groups 2, 3, and 4 are not significantly different from each other with respect to average change, while they are all different from Group 1, which shows a significantly greater change.

IN OTHER WORDS, THE SINISTRAL-INVERTED TREATMENT GROUP SHOWS A SIGNIFICANTLY GREATER INCREASE IN ACCURACY THAN EITHER OF THE OTHER THREE GROUPS, NAMELY, THE SINISTRAL NON-INVERTED, THE DEXTRAL-INVERTED, AND THE NON DEXTRAL-INVERTED.

Exhibit 4 presents the analysis of covariance table in which the dependent variable is the change in comprehension scores, the covariate is the pre-comprehension score and the independent factors are group and sex.

EXHIBIT 4. Analysis of Covariance Report for Comprehension Change Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F	p Value
X(Pre-Comprehension)	1	4.73	4.73	10.37	0.003**
A(Group)	3	17.65	5.88	12.92	0.000**
B(Sex)	1	2.60	2.60	5.72	0.022*
AxB	3	1.08	0.36	0.79	0.509
Residual	34	15.49	0.46		
Total(adjusted)	42	59.31			

* Significant at $\alpha = .05$; ** Significant at $\alpha = .01$.

From Exhibit 4, the following conclusions may be drawn:

1. with a p = .003, the hypothesis of no correlation between the pre-test comprehension score and the change in comprehension scores is rejected.
2. with a p = .000, the hypothesis of no difference in average change in comprehension scores across the four groups, when adjusting for the significant linear effect of the pre-test comprehension scores, is rejected.
3. with a p = .022, the hypothesis of no difference between males and females in average change in comprehension scores when adjusting for the significant linear effect of the pre-test comprehension scores, is rejected. The conclusion is that males, on average, show a significantly greater change in their comprehension scores than do females.
4. with a p = .509, the hypothesis of no interaction between sex and group with respect to average change in comprehension scores cannot be rejected:

The use of Fisher's LSD test indicates that Groups 2, 3, and 4 are not significantly different from each other with respect to average change, while they are all different from Group 1, which shows a significantly greater change.

IN OTHER WORDS, THE SINISTRAL-INVERTED TREATMENT GROUP SHOWS A SIGNIFICANTLY GREATER INCREASE IN COMPREHENSION THAN EITHER OF THE OTHER THREE GROUPS, NAMELY, THE SINISTRAL NON-INVERTED, THE DEXTRAL-INVERTED, AND THE NON DEXTRAL-INVERTED.

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Conclusions

The future is a vision for tomorrow, and history is but the sum of yesterdays. As educators, the dream of positively impacting the progress of each and every student is no different today than it was yesterday or will be tomorrow. How do we maximize student progress? How do we ensure equity, access to instruction and opportunity to excel?

It was most evident to these researchers that equal access is a matter first and foremost of leveling. If we are to ensure equity, we must level the learning field. Beyond any statistical doubt, this study has determined that sidedness – visually, auditorially, kinesthetically and academically – profoundly affected the performance of students. Students from highly diverse ethnic and socio-economic backgrounds, and special education, regular education, Gifted and Talented, and English as a Second Language programs completed their given tasks in a significantly more positive manner in their sided/natural states. The treatment group (sinistral-inverted) maintained dramatically different results on the reading accuracy and comprehension tests. The high percentage of special education students who lack sidedness must be considered in a new light. Is the lack of sidedness the true problem for so many students who are learning disabled or in need of remedial programs? Ponder the possibilities of students being screened for sidedness early on in their educational careers; ponder the years of potential success rather than the years of frustration and failure. "Life-long" learning is an asset; "life-long" status in remedial programs is a liability.

The authors of this study believe, without statistical reservation, that students must be sided in order to fulfill their learning potential. Sidedness, in contrast to earlier studies, must be determined by identifying the ***reading-range eye*** as opposed to the identification of the far-range eye. When the reading-range eye and hand are aligned, the reading circuitry is complete – the field is now level for learning..

Glossary

Alignment: arrangement of the eye, ear, and hand on one side of the body.
Bimono-scope: an instrument that determines eye preferences at near, 16" reading, and far-point ranges.
Cerebral lateralization: dominating either right or left cerebral hemisphere.
Contralateral: left-handed person who does not utilize the language hemisphere of the brain (non-hooked).
Functional/operational: state in which one currently performs.
Ipsilateral: t elonging to or occurring on the same side of the body.
Non-sided: lack of alignment of eye, ear, and hand.
Occlude: to restrain the eye, ear and hand on one side of the body.
Practice: a skill gained by experience or exercise.
Preferred: to choose and utilize one eye, ear or hand in place of the other.
Proper scanning position: the slant of the paper is at a 45 degree angle to the left for all scanning or handwriting.
Sided: total alignment of the eye, ear, and hand on one side of the body, as determined by the reading-range eye.
Visual hemifield procedures: a device or procedure, which presents brief visual stimulation to the right or left half of the visual field.

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